AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

Listing of Claims

Claim 1 (currently amended): A resist pattern forming method comprising the steps of:

forming on a substrate a photoresist film having an opening down to the substrate, a sidewall of the photoregist film in the opening having hydrophilicity and affinity with a chemical liquid, and the hydrophilicity and affinity being increased upward; and

reacting the chemical liquid for swelling the photoresist film with the photoresist film having the opening to swell the photoresist film and to reverse-taper the sidewall of the photoregist film in the opening.

Claim 2 (cancelled)

Claim 3 (original): A resist pattern forming method according to claim 1, further comprising, after the step of forming the photoresist film, the step of:

performing a processing for increasing a hydrophilicity and a affinity with the chemical liquid of a surface region of the photoresist film.

Claim 4 (original): A resist pattern forming method according to claim 1, wherein

the step of forming the photoresist film includes the steps of:

forming a first resin film;

forming on the first resin film a second resin film whose reactivity with the chemical liquid is different from that of the first resin film; and

forming the opening in the second resin film and the first resin film.

Claim 5 (original): A resist pattern forming method according to claim 4, wherein

a pre-bake temperature for forming the first resin film is higher than a pre-bake temperature for forming the second resin film.

Claim 6 (original): A resist pattern forming method according to claim 4, wherein

in the step of forming the first resin film, the first resin film containing a first base resin is formed, and

in the step of forming the second resin film, the second resin film containing a second base resin whose reactivity with the chemical liquid is different from that of the first base resin and is photosensitive is formed.

Claim 7 (original): A resist pattern forming method according to claim 4, wherein

a contact angle of the first resin film to the chemical liquid is larger by not less than 5° than a contact angle of the second resin to the chemical liquid.

Claim 8 (original): A resist pattern forming method according to claim 1, wherein a minimum opening width of the opening is below a resolution of the photoresist film.

Claim 9 (original): A resist pattern forming method according to claim 1, wherein the photoresist film contains a film of a novolak-based photoresist material or a poly (methyl methacrylate)-based resist material.

Claim 10 (original): A resist pattern forming method according to claim 1, wherein the chemical liquid contains at least one component selected from the group consisting of a resin, a crosslinking agent and a surfactant.

Claim 11 (original): A resist pattern forming method according to claim 10, wherein the chemical liquid has water solubility or alkali solubility.

Claim 12 (original): A resist pattern forming method according to claim 10, wherein the surfactant is a non-ionic surfactant.

Claim 13 (original): A resist pattern forming method according to claim 10, wherein

the resin is at least one material selected from the group consisting of poly (vinyl alcohol), poly (vinyl acetal) and poly(vinyl acetate).

Claim 14 (original): A resist pattern forming method according to claims 10, wherein the crosslinking agent is at least one material selected from the group consisting of melamine derivatives, urea derivatives and uryl derivatives.

Claim 15 (original): A resist pattern forming method according claim 10, wherein the chemical liquid further contains at least one material selected from the group consisting of water soluble aromatic compounds and resins partially containing aromatic compound.

Claim 16 (original): A resist pattern forming method according to claim 15, wherein the water soluble aromatic compound is selected from the group consisting of polyphenol compounds, aromatic carboxylic compounds, naphthalene polyhydric alcohol compounds, benzophenone compounds, flavonoid compounds, their derivatives and their glycosides, and the resin partially containing aromatic compound is selected from the group consisting of poly (vinyl aryl acetal) resin, poly (vinyl aryl ether) resin and poly (vinyl aryl ester) resin.

Claim 17 (original): A resist pattern forming method according to claim 10, wherein

the chemical liquid further contains as an organic solvent at least one solvent selected from the group consisting of alcohol-based solvents, chain ester-based solvents, cyclic ester-based solvents, ketone-based solvents, chain ether-based solvents and cyclic ether-based solvents.

Claim 18 (currently amended): A semiconductor device fabrication method comprising the steps of:

forming over a semiconductor substrate a photoresist film having an opening down to the semiconductor substrate, a sidewall of the photoregist film in the opening having hydrophilicity and affinity with a chemical liquid, and the hydrophilicity and affinity being increased upward;

reacting the chemical liquid for swelling the photoresist film with the photoresist film having the opening to swell the photoresist film and to reverse-taper the sidewall of the photoregist film in the opening; and

depositing a conducting film, and then selectively removing the conducting film on the photoresist film together with the photoresist film to form an electrode of the conducting film in the opening.

Claim 19 (currently amended): A semiconductor device fabrication method comprising the steps of:

forming an insulating film over a semiconductor substrate;

forming on the insulating film a photoresist film having a first opening down to the insulating film, a sidewall of the photoresist film in the first opening having hydrophilicity and affinity with a chemical liquid, and the hydrophilicity and affinity being increased upward;

etching the insulating film with the photoresist film as a mask to form a second opening in the insulating film down to the semiconductor substrate;

reacting the chemical liquid for swelling the photoresist film with the photoresist film having the first opening to swell the photoresist film and to reverse-taper the sidewall of the photoregist film in the first opening; and

depositing a conducting film, and then selectively removing the conducting film on the photoresist film together with the photoresist film to form an electrode of the conducting film in the second opening.

Claim 20 (original): A semiconductor device fabrication method according to claim 19. wherein

the step of forming the second opening is performed before the step of swelling the photoresist film.

Claim 21 (original): A semiconductor device fabrication method according to claim 20, wherein

in the step of forming the second opening, a width of the first opening is made larger than a width of the second opening.

Claim 22 (original): A semiconductor device fabrication method according to claim 21, wherein

in the step of forming the electrode, the electrode extended over the insulating film is formed.

Claim 23 (original): A semiconductor device fabrication method according to claim 19, wherein

the step of forming the second opening is performed after the step of swelling the photoresist film.

Claim 24 (new): A resist pattern forming method according to claim 1, wherein

in the step of reacting the chemical liquid with the photoresist film, a soft baking at a first temperature and a hard baking at a second temperature higher than the first temperature are performed.

Claim 25 (new): A semiconductor device fabrication method according to claim 18, wherein

in the step of reacting the chemical liquid with the photoresist film, a soft baking at a first temperature and a hard baking at a second temperature higher than the first temperature are performed.

26 (new): A semiconductor device fabrication method according to claim 19, wherein in the step of reacting the chemical liquid with the photoresist film, a soft baking at a first temperature and a hard baking at a second temperature higher than the first temperature are performed.